WHAT IS CLAIMED IS

1. A method for the synthesis of large area uniform silicon cone arrays on a substrate by ion-beam sputtering, wherein total pressure is kept at 2 $x10^{-4}$Torr, silicon is used as a substrate, and a metal is used as a catalyst.

2. A method as claimed in claim 1 wherein the sputter gas is selected from any of helium, neon, argon, xenon and hydrogen.

3. A method as claimed in claim 1 wherein the catalyst is selected from any of the group consisting of molybdenum, tungsten and nickel.

4. A method as claimed in claim 1 wherein the substrate temperature ranges from 100°C to 600°C.

5. A method as claimed in claim 1 wherein the ion energy is maintained in the range of 100eV to 1000eV.

6. A method as claimed in claim 1 wherein the angle between the center ion-beam and the substrate surface normal ranges from 0 to 90 degrees.

7. A method as claimed in claim 1 wherein the fabrication time is between 30-240 minutes.

8. A method for the synthesis of large area uniform cone arrays made of a first material by ion-beam sputtering, wherein the first material is used as a

substrate, and a second material is used as a catalyst, wherein the second material is a metal.

9. A method as claimed in claim 8 wherein the first material is selected from the group consisting of germanium, copper, or graphite.

10. Apparatus for ion-beam sputtering of large area uniform silicon cones, comprising a high vacuum chamber suitable for ion-beam sputtering, an ion-source, means for holding a substrate in the chamber, means for arranging a metal catalyst around the substrate, means for adjusting the substrate temperature and means for adjusting the angles between the center ion-beam and the substrate surface normal.

11. Apparatus as claimed in claim 10 wherein the ion source is an rf ion source or a Kaufman ion-source.

12. Apparatus as claimed in claim 10 wherein the substrate holder clamp is made of molybdenum, tungsten, or nickel.

13. ~~A method for silicon cone surface modification by acid etching, wherein a hydrofluoric acid is used as an etchant, and de-ionized water is used as a stopper.~~

14. ~~A method as claimed in claim 13 wherein the concentration of hydrofluoric (HF) acid ranges from 1 % to 48%.~~

15. A method as claimed in claim 13 wherein the etching time is between 10 seconds to 10 minutes.

16. A method as claimed in claim 13 wherein the acid used is selected from HF acid, or a mixture of HF acid and HNO_3, HCl, or H_2SO_4.

17. A method for silicon cone surface modification comprsing annealing under ultra-high vacuum conditions.

18. A method as claimed in claim 17 wherein the annealing temperature is between 100 to 800°C.

19. A method as claimed in claim 17 wherein the annealing time is between 10-30 minutes.

20. A method for silicon cone surface modification by low work function metal coating, wherein a low work function material is used as a coating material.

21. A method as claimed in claim 20 wherein the low-function coating material is selected from Cesium and diamond like carbon (DLC).

22. A method as claimed in claim 20 wherein the coating thickness ranges from 100 to 1000 angstrom.

23. A method for growing silicon oxide nanowires on the tips of the silicon cones by heating, wherein the silicon cone is used as the substrate, metal/metal siliside cone tip is used as the catalyst, and inert gas is used as a protective gas.

24. A method as claimed in claim 23 wherein the inert gas is selected from helium, neon, argon, and xenon.

25. A method as claimed in claim 23 wherein the total pressure during growth is maintained at 15 to 25 Torr.

26. A method as claimed in claim 23 wherein the growth time is between 5 to 10 minutes.

27. A method as claimed in claim 23 wherein the growth temperature ranges from 900 to 950°C.

28. A method for growing crystalline silicon nanowires on the tips of the silicon cones by heating, wherein the silicon cone is used as the substrate, metal/metal siliside cone tip is used as the catalyst, inert gas is used as a protective gas, and hydrogen is used as a reductive gas.

29. A method as claimed in claim 28 wherein the inert gas is selected from helium, neon, argon, and xenon.

30. A method as claimed in claim 28 wherein the total pressure during growth is maintained at 15 to 25 Torr.

31. A method as claimed in claim 28 wherein the growth time is between 5 to 10 minutes.

32. A method as claimed in claim 28 wherein the growth temperature ranges from 900 to 950°C.

33. A method as claimed in claim 28 wherein the ratio between the inert gas and hydrogen ranges from 90:10 to 0:100.

34. A method as claimed in claim 28 wherein a hot filament excitation is employed.

35. A method as claimed in claim 34 wherein the filament temperature is maintained in the range of 1800°C to 2300°C.

36. A method as claimed in claim 34 wherein the excitation can be from rf, microwave or dc plasma source.

37. Apparatus for the high temperature growth of nanowires on tips of the silicon cones, comprising a vacuum chamber, means for holding a substrate in the chamber, means for supporting filaments in the chamber, and means for adjusting the substrate temperature.